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DESCRIPTION AND BIONOMICS OF CAECILIUS MANTERI N. SP. (Corrodentia).[1]

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During a study of the bionomics of some corn (maize) stalk-infesting Corrodentia two species of *Caecilius* have been taken, both of which appear to be new. One of these, *Caecilius manteri*, is the tenth species in this genus to be recorded from the United States. It has been taken from Mt. Carmel, Conn., and Glen Ellyn, Ill.

DESCRIPTION

Caecilius manteri, n. sp.

According to the characters mentioned by Chapman (2) and Aaron (1), this species resembles *Caecilius subflavus* Aaron in size, paleness, general uniform wing color, and the usual absence of hairs on the postcubital vein. It differs from *subflavus* in color intensity, being darker, and in color pattern of the head and wing veins.

C. manteri is most easily recognized by its small size, buff color, golden brown eyes, fuscous lateral stripe, and tan forewings with veins brown in the distal two-fifths.

Female.—(Figs. 3, 4). The range of measurements of ten specimens is as follows: total length 2.07 mm. to 2.88 mm., head width 0.495 mm. to 0.549 mm., antennal length 1.647 mm. to 1.962 mm., and forewing length 1.665 mm. to 2.205 mm.

Head: Vertex clouded with light brown behind ocelli; front light brown; ocelli pale; ocellar interval light brown; clypeus faintly lineated with eight

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[2] I wish to express my appreciation of the suggestions made by Professors C. L. Metcalf and W. V. Balduf during this work. Thanks are also due Dr. A. B. Gurney of the U. S. Bureau of Entomology and Plant Quarantine, Dr. E. T. Cresson, Jr., of the Philadelphia Academy of Natural Sciences, and Mr. Nathan Banks of the Museum of Comparative Zoology, Harvard University, for their comparisons of *Caecilius manteri n. sp.* with closely related species.

or ten mesally directed brown bands fading anteriorly; labrum tan; fuscous band from anterior margin of eye above base of antenna to clypeus, and from rear margin of eye posteriorly. Length of thirteen antennal segments in the following proportions: 1 : 1 : 4 : 2.8 : 2.5 : 2.4 : 1.7 : 1.7 : 1.6 : 1.6 : 1.3 : 1.3 : 1.8; first three and a half pale, others brown, darkest at tip. Maxillary palpus light tan, dark at tip; fork of lacinia almost obscure. Paraglossae pale. Eyes orange brown in living specimens, black in alcoholic.

Thorax: Irregular fuscous band along pleura, across episternum and epimeron of prothorax, following dorsal margin of anepisternum of pterothoracic segments to abdomen; anterior surface of middle lobe of mesothoracic scutum brown, dorsal part of lateral lobes of mesothoracic scutum light brown; scutoscutellar suture very prominent on mesoscutum; lateral lobes of mesothoracic scutum light brown, pleura and sterna buff, tinged with tan; ventrally mesothoracic katepisterna orange brown. Legs pale, anterior tibiae darkest brown, second segment of tarsus darker than first, claws dark brown. Forewing tan, slightly darker toward base, first vanal cell darkest; veins brown in distal two-fifths, hyaline in basal three-fifths; stigma opaque, hairy. Hind wings almost hyaline.

Abdomen: Pale buff with infuscate dorso-lateral stripe. Genitalia (Fig. 5) colorless; subgenital plate (Sg. P.) not greatly modified, apex bluntly pointed and non-pilose. Gonapophyses (G.) consist of two pairs of slender, sharp-pointed parallel blades, similar to those of *Caecilius posticus* Banks as figured by Chapman (2). Distal half of lateral sclerites of tenth tergum covered with setae. Sensory tubercles (S. T.) light brown, covered with long delicate setae. Suranal plate (Sa. P.) pilose, with two longer setae distally.

Male.—Not known.

Type locality.—Mt. Carmel, Connecticut.

Holotype.—Female, Ill. State Nat. Hist. Surv., Urbana, Ill.

Paratypes.—Two females, Ill. State Nat. Hist. Surv., Urbana, Ill. Three females, U. S. Nat. Mus., Washington, D. C. Three females, Mus. of Comp. Zool., Harvard Univ., Cambridge, Mass. Three females, author's collection.

This species is named in honor of my former teacher, Professor J. A. Manter of the Department of Zoology, University of Connecticut.

Anomalies in wing venation were observed chiefly in the cubital and median veins. In Figure 13, M_2 and M_{3+4} are fused at the base. In Figure 14 there is a cross-vein between R—M and Cu, and in Figure 15 M_{3+4} is absent. Some of these peculiarities occurred on both forewings. A few specimens had one or two setae on the postcubital vein, as in *Caecilius croesus* Chapman, but in the majority this vein was bare.

BIONOMICS.

From the original group of six eggs collected on the inner surface of a corn sheath December 30, 1939, five nymphs hatched and four matured. These were females and all the adults raised under laboratory conditions, from the F_1 through the F_6 generation, likewise were females. It is evident that parthenogenesis exists in this species; so males probably do not occur. Of the thirty-five United States species belonging to this family, this is one of eleven in which only the female is known, and of the ten species included in this genus it is the only one known to be parthenogenetic.

Oviposition.—Egg laying started from one to three days after moulting to the adult and continued one to three weeks. Usually a small number of eggs was laid the first time, and likewise the number dwindled as the end of the oviposition period approached. The eggs were laid in groups from one to eleven, but most commonly in masses of four, five, seven or eight. Although the females seemed to prefer the surface of the corn, eggs sometimes were laid on the glass of the cages. The number of egg masses per individual ranged from one to twenty. Sometimes two masses were laid in one day. The maximum number of eggs deposited by any one individual was ninety-five. Death occurred from one to three days after oviposition ceased.

Eggs were deposited one at a time with an interval between, during which the female nibbled about on the sheath, returning often to the previously laid eggs. Finally the abdomen was pressed down beside the other eggs for a few seconds, and when it was raised the egg remained. After the last egg had been laid the process of covering the mass with silk began. The female touched her labium to the sheath here and there, then over the eggs, back and forth continuously, until the mass was covered with a delicate sheet of densely laid strands. The two individuals observed, worked in general, from the circumference of the mass in toward the center. It required fifteen minutes for one female to cover a mass of eight eggs, and ten minutes for the other to cover a group of four. Rarely were masses found lacking the sheet of silk.

Egg Stage.—The eggs (Fig. 1) are oblong with rounded ends and slightly curved sides. The surface is smooth and shiny. Measurements of fifteen eggs chosen at random averaged 0.418 mm. in length and 0.181 mm. in width. The eggs were white when first laid, but after thirty-six hours or so the vitelline membrane turned an iridescent bluish-brown dorsally. There remained at the anterior end an irregular U-shaped, light colored area. Some eggs about twenty-four hours old, still almost white, seemed to darken immediately while under the microscope light. The only external signs of embryonic develop-

ment were the darkening of the vitelline membrane and the appearance of the dark eyes of the embryo through the chorion on the fifth day. Of fifteen egg masses, six hatched on the sixth day, two partly on the sixth and partly on the seventh, and seven on the seventh.

Hatching.—The U-shaped, light colored area at the dorso-anterior end of the egg widened. The chorion and vitelline membrane split and in a minute the head of the pronymph was seen coming out. The egg burster (Fig. 2) is borne on the front of the head inside the membrane surrounding the nymph. This differs from the reports of Wachter (7) and Peyerimhoff (4) who state that the egg burster ruptures the chorion, and that the vitelline membrane is broken by internal pressure, which implies that the egg burster is on the outside of the vitelline membrane. Observations during this work indicate that the chorion and vitelline membrane break first, probably due to internal pressure, and the embryo surrounded by the intact pronymphal membrane emerges. The egg burster is wishbone-shaped and each arm contains twelve or thirteen teeth. The front of the head appeared to be pulsating and when viewed from the side the pronymphal membrane could be seen stretched tightly across the burster. Then the eye facets showed distinctly, also the pubescence on the front of the head, indicating the sudden casting of the pronymphal membrane. Five minutes later bubbles of air were seen passing along inside the head. When the nymph was about three-quarters of the way out a continuous stream of bubbles appeared to be going down the oesophagous. The legs and antennae were finally freed from the pronymphal membrane in thirteen minutes from the time hatching started. This was brought about by the process of body inflation, aided by a forward and backward swaying of the body. The nymph remained quietly in a vertical position for a minute then bent over, freeing the tip of the abdomen. It remained practically motionless and no more bubbles could be seen passing within. The large bubble inside extended into the abdomen about three-quarters of its length. At this time the nymph was long and narrow, longer than the egg. Slight abdominal movements followed, after which the large bubble extended into the head as far as the posterior margin of the eyes. Within twenty minutes the abdomen had contracted until it was shorter than the rest of the body, but it lengthened again after feeding. The pronymphal exuviae bearing the egg burster always remained partly extruded from the chorion.

Postembryonic Development.—The first instar nymph (Fig. 7) is buff with an indication of a lateral fuscous stripe extending from the rear margin of the black eyes to the abdomen. The antennae are eight-segmented. Feeding commenced shortly after hatching. The first instar period required 3.4 days.

The second instar nymph (Fig. 8) is similar to the first in color, but the lateral fuscous stripe is more pronounced and appears, in addition, from the eyes to the antennae. The antennae are twelve or thirteen-segmented. The division of the third segment is not so distinct as the others. Apparently the third (?), fourth, fifth, sixth and seventh antennal segments of the first instar nymph give rise to two segments each. The second instar period required 3.3 days.

The third instar nymph (Fig. 9) is similar to the second, but the lateral fuscous stripe is more pronounced, the eyes are lighter in color, and there is a tendency in some specimens toward a cloudiness along the abdomen. The wing pads appear for the first time in this instar. The third instar period required 2.9 days.

The fourth instar nymph (Fig. 10), fifth (Fig. 11) and sixth (Fig. 12) are similar to the third in color pattern, and besides the general increase in size and the gradual change in eye color, there is little noticeable difference. The wing pads, which are thin in the early part of each instar period, become thicker as development progresses, and are very plump and project decidedly from the body the day before moulting. The wing pads about double their length with each moult. The fourth, fifth and sixth instar periods averaged 3.2, 3.0 and 3.9 days respectively. Averages of the measurements of eleven to fifteen specimens in each instar are given in the following table (Measurements in mm.):

Instar	*First*	*Second*	*Third*	*Fourth*	*Fifth*	*Sixth*
	mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
Head width.....	0.184	0.235	0.291	0.364	0.405	0.512
Antennal length...	0.397	0.527	0.654	0.859	1.112	1.566
Forewing length.....			0.094	0.188	0.349	0.714

The complete nymphal period averaged 19.8 days, which undoubtedly varies with the amount of food available in the form of fungous growths; since the nymphal period of twenty-eight days was cut to nineteen when the pieces of corn sheath were changed every other day, instead of only two or three times during the nymphal period.

Immediately after the sixth moult the adult is light in color like the nymphs, but the eyes are a bright orange brown. Pigmentation proceeds rapidly, for within an hour, the lines on the clypeus show, and the distal part of the wing veins is dark. The adult period averaged 12 days, with the maximum being 26 days. The total of all the life stages averaged 38 days.

Moulting.—Judging from the grouping of the exuviae, in most cases there seemed to be a tendency for the nymph to return to the same spot when ready for the next moult. Almost all

the exuviae were in a vertical position with the head down. The process of moulting was not observed for all instars, but required about five minutes for those observed. The epidermis split along the top of the head and thorax. The caeciliid arched up, with the antennae held down along the sides of the body. The head was finally freed and gradually the nymph rose up until it was actually resting on the end of the abdomen, although the tarsi of the exuviae were in contact with the substratum. When almost vertical the antennae were released, then the legs. During all this time air bubbles were being swallowed and the abdomen stretched out. After exercising the legs it bent over, freeing the tip of the abdomen, and stood beside the exuviae. After a short time the abdomen contracted to its normal length.

Habits.—Nymphs and adults were observed eating fungous hyphae that extended along the inside of the glass cage. They were at times observed attempting to feed on their own excrement, but the pellets were too large for them to chew. Occasionally exuviae could not be accounted for and may have been eaten, but the majority were not. This species must have depended almost entirely on fungus for food because it did not appear to feed on the eggs, exuviae, epidermis or mesophyll of the corn sheath. Silk webbing was deposited by all instars and adults, but it was hardly noticeable. In contrast to this, the eggs were covered with a very dense sheet of silk. This species reacted to moisture by giving a sudden start as if aware of the presence of water when the plugs were moistened, and presumably took moisture from the wet cotton plugs in the cages described by the writer, Sommerman (5). This is a delicate species, dying if the food was not changed often, or the cotton plugs in the cages kept moist. Because of this sensitivity colony cultures were not successful.

Overwintering.—There is a decided lack of field information concerning this species. The five egg masses taken during this study were found on the inner surface of the corn sheaths, about four or five feet up on the erect stalks. Four of these egg masses were collected March 14, 1941, in Glen Ellyn, Ill., by Miss A. Edmondson, and they all hatched and matured. Since the eggs collected in Mt. Carmel, Conn., on December 30, 1939, also hatched, and since adults were not found on the corn at either time, although those of *Ectopsocus pumilis* (Banks) were present, it seems possible that this species overwinters only in the egg stage. This is further suggested by collection and rearing data of *Caecilius aurantiacus* Hagen from the banks of the Middlefork River near Danville, Ill. Egg masses of *C. aurantiacus*, collected on fallen leaves of maple, cottonwood, willow and elm hatched in February and March when brought inside at that time, while others of *C. aurantiacus* that were left out of

doors hatched April 8, 1940, and neither living nymphs nor adults were found throughout the winter.

Parasitism.—Alaptus caecilii Girault (Hym. Mymaridae) has been recorded from Florida from "psocid eggs," and from California from the eggs of *Caecilius aurantiacus* Hagen according to Girault (3), and from *Ectopsocus californicus* (Banks) according to Spruyt (6). The following record from Illinois suggests the possibility of continuous widespread distribution. Adults of *Alaptus caecilii*, determined by Mr. A. B. Gahan of the U. S. Bureau of Entomology and Plant Quarantine, emerged December 18 from eggs of *Caecilius aurantiacus* collected October 28, 1939. Two emerging adults of this parasite were timed and it required forty-eight and fifty-two minutes to chew a hole in the chorion through which to emerge. According to Spruyt (l. c.) a related species, *Alaptus psocidivorus* Gahan, emerges from the host egg by moistening the shell and pushing its way out. Eighty-five egg masses (799 eggs) of *C. aurantiacus* were collected in an hour on February 15, 1940, near Danville as mentioned above. These were left out of doors until March 7, then brought into the laboratory. They hatched March 13 and 14. Parasites emerged from the non-hatched eggs March 30. The nymphal stage of the caeciliid lasted about two weeks in the colony cultures; so it is obvious that these parasites emerge about the time the host is depositing eggs. It was interesting to note that on January 11 of the following year when a collection was made in the same place only one egg mass was found, from which caeciliids emerged in the spring. Either the parasites had been very successful in reducing the numbers of the host the previous year, or environmental conditions were not favorable.

Some freshly laid eggs of *C. manteri* were subjected to *Alaptus caecilii* adults that had emerged from the eggs of *C. aurantiacus* on April 5. Three days later the yolk of the caeciliid egg was moving. On April 9 motion still continued and on April 10 there was just an occasional pulsation. On April 11 two dark spots, probably the eyes (transmitted light) connected by a narrow band could be seen at one end of the egg, and at the other an apparently empty space. At this time no movement was observed. On April 17 there was still no movement, and on April 30 adult parasites emerged. Thus the period from oviposition to emergence required twenty-five days in this particular instance. In another case *C. manteri* eggs, lacking one day of hatching, were subjected to the parasites and it appeared as though oviposition had occurred, but the following day the nymphs hatched, apparently with no ill effects.

On March 16 another group of *Alaptus caecilii* adults emerged from the eggs of *C. aurantiacus;* and freshly laid eggs of *C. manteri* were exposed to them. Parasites emerged from these

on April 2; so a new mass of *C. manteri* eggs was put in. Adult parasites emerged from this egg mass on April 17. The completion of two generations of parasites on the eggs of *C. manteri* in the laboratory suggests that the eggs might well be parasitized by this species under natural conditions. Thus in two cases the period from oviposition to emergence of *A. caecilii* was sixteen and fifteen days respectively.

Summary

Eggs of *Caecilius manteri* have been taken from corn stalks in Illinois and Connecticut. This species is parthenogenetic. The eggs are smooth-shelled and are laid in masses covered with a dense sheet of silk. Abundance of food in the form of fungus affects the maturing eggs, more being laid when food is plentiful. The egg burster, apparently on the inside of the pronymphal membrane, is used to puncture the latter, while the chorion and vitelline membrane are probably broken by internal pressure. The egg stage requires about six days. The nymphs swallow air bubbles at hatching and at moulting. The pronymphal membrane, with the egg burster attached, is always found protruding from the chorion after hatching. The antennae are eight-segmented in the first instar, twelve or thirteen-segmented in the second, and thirteen-segmented thereafter. Wing pads appear on the third instar and about double their length with each moult. During moulting the nymphs are in a vertical position with their heads down. The nymphal stage requires about nineteen days, and the adult stage lasts about twelve days. Thirty-eight days is the total time required for the three life stages, egg, nymph and adult. Silk is deposited by all nymphs and adults. The winter is probably spent in the egg stage. In the laboratory *C. manteri* has been successfully parasitized by *Alaptus caecilii* Girault, a parasite of *Caecilius aurantiacus* Hagen.

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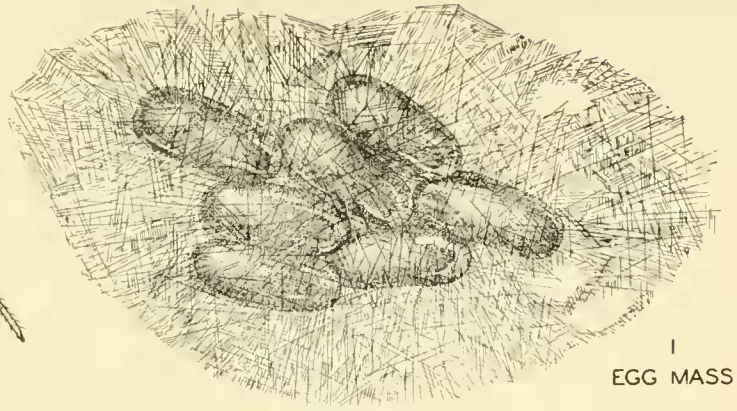
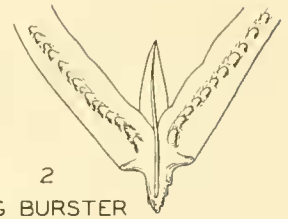


1
EGG MASS

CAECILIUS MANTERI N. SP.



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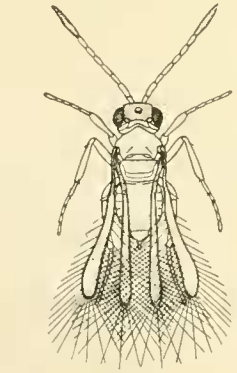
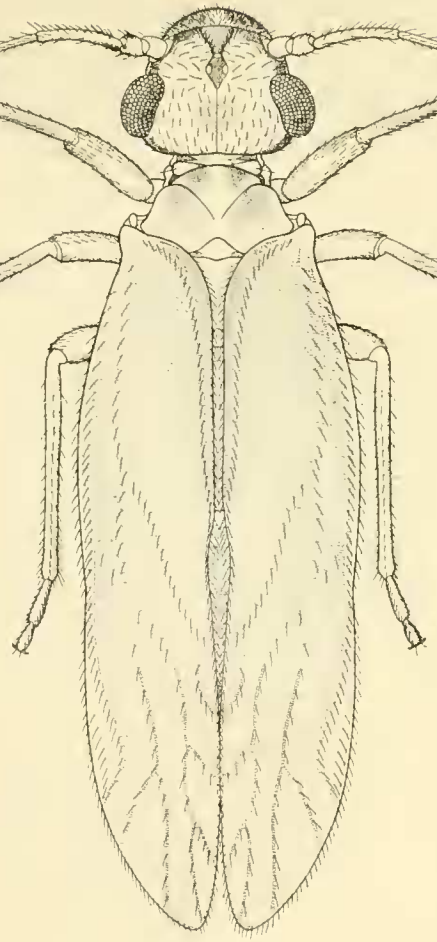
EGG BURSTER

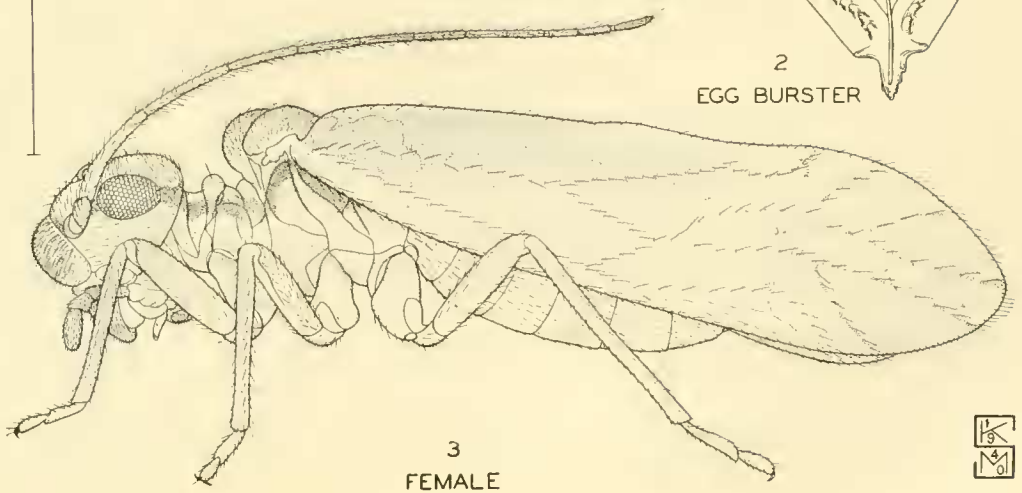


6
EGG PARASITE
ALAPTUS CAECILII GIRAULT



1 MM

4
FEMALE



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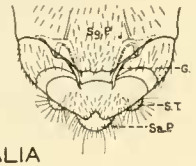
FEMALE



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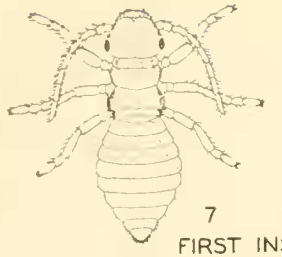
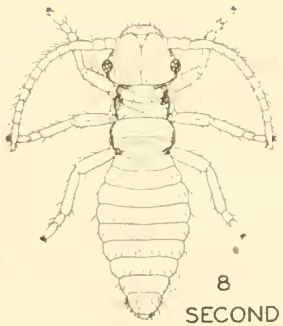
GENITALIA



7
FIRST INSTAR



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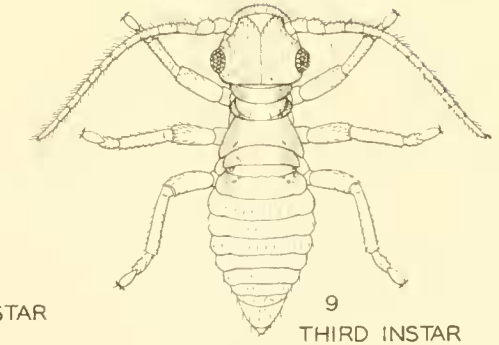
SECOND INSTAR



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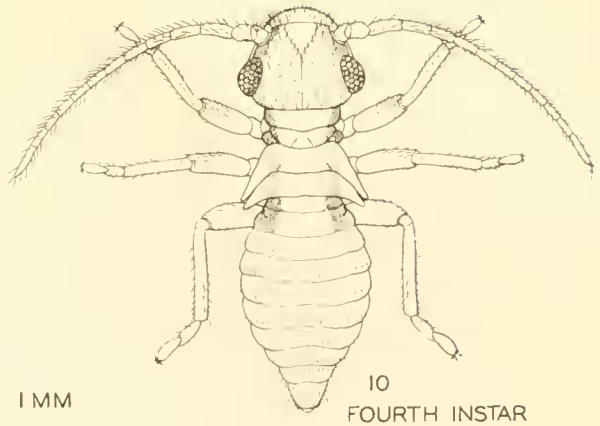
THIRD INSTAR

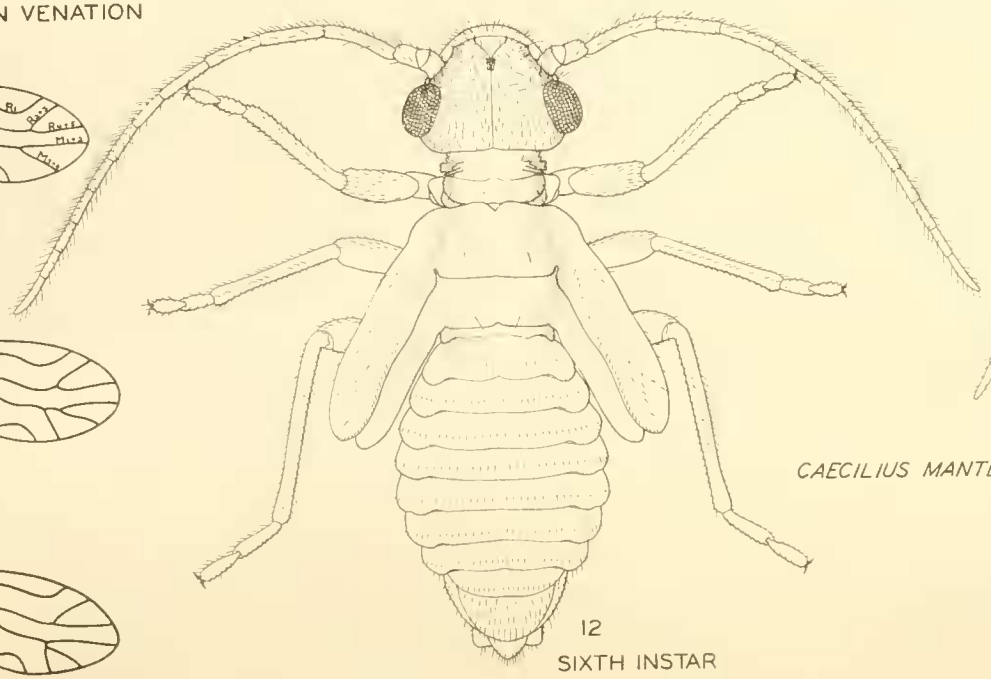


10
FOURTH INSTAR

1 MM

VARIABILITIES IN VENATION

15



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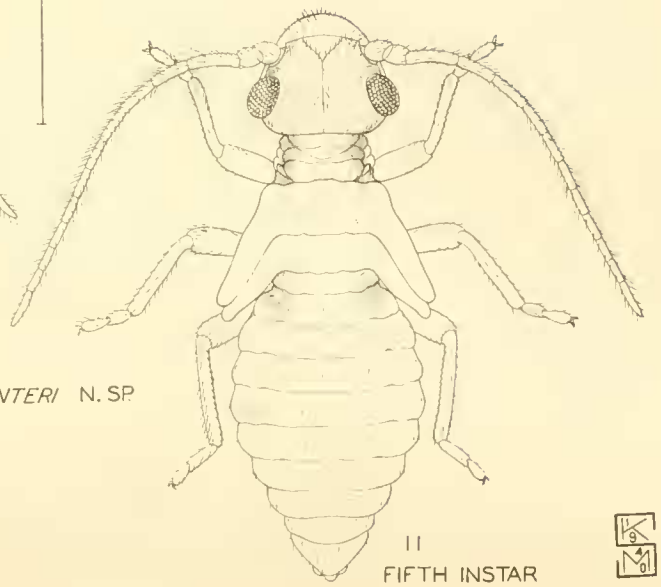
SIXTH INSTAR



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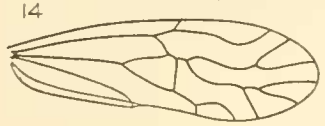
FIFTH INSTAR

14



13

CAECILIUS MANTERI N. SP.

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Explanation of Plates.

PLATE I.

Figure 1. Egg mass covered with silk sheet.
Figure 2. Tip of egg burster.
Figure 3. Female (lateral view).
Figure 4. Female (dorsal view).
Figure 5. Genitalia (ventral view), Sg. P. subgenital plate, G. gonapophyses, S. T. sensory tubercles, Sa. P. suranal plate.
Figure 6. Adult of *Alaptus caecilii* Girault (dorsal view of female).

PLATE II.

Figure 7. First instar.
Figure 8. Second instar.
Figure 9. Third instar.
Figure 10. Fourth instar.
Figure 11. Fifth instar.
Figure 12. Sixth instar.
Figures 13, 14, 15. Variability in wing venation.

A NEW SERICOTHRIPS ON ELM (Thysanoptera: Thripidae).

By J. C. Crawford,
Bureau of Entomology and Plant Quarantine, United States Department of Agriculture.

The leaves of elm have long been searched for Thysanoptera by Floyd Andre and by the author but without success. This year, however, Dr. Andre found adults and nymphs of *Sericothrips nubilipennis* Hood on the fully developed leaves, and at the same time the following new species was discovered in the unfolding young leaves.

Sericothrips andrei, new species.

Female (holotype).—Length (somewhat distended) 1.05 mm. Body dark brown with much suffused reddish internal pigmentation, femora